AMRAD Newsletter

AMATEUR RADIO RESEARCH AND DEVELOPMENT CORPORATION

P.O. Drawer 6148 *McLean, VA. USA 22106-6148* Vol. XV - No.4

CALENDAR

Meetings are normally held on the first Monday of each month at the Red Cross Building in Merrifield Va., unless the Monday falls on a holiday.

Saturday	Sept 10	O.D. 35
Monday	Sept 12	meeting at Vienna Library
Saturday	Sept 24-25	World Championship Ride
Monday	Oct 3	meeting at Red Cross Building
Saturday	Oct 8	copy to editor for Nov NL
Sat	Oct 22	O.D. 50
Monday	Nov 7	meeting
Monday	Dec 5	meeting
Saturday	Dec 10	copy to editor for Jan NL

AMRAD is publishing six Newsletter issues a year (odd numbered months). Authors are encouraged to submit copy to the editor by the dates listed in the calendar for the Newsletters indicated. The originals of figures, pictures, or graphics should be directed to the Publisher (Bill Pala) with a copy to the Editor (Deborah Borden).

NOTICE

As of OCTOBER 1st, 1988, the AMRAD meetings will take place at a new location which we have obtained through the good offices of Joe Peters, WB4WZZ. As some of you may know, quite a few times recently we could not get access to the Vienna Public Library on the days we had planned. Hence, we are moving to a new location. The NEW LOCATION is the RED CROSS BUILDING, located at the intersection of Old Lee Highway and Hilltop Road, in Merrifield, Va, about half a mile south-east of Vienna.

Directions: While driving on Cedar Lane, turn east on Hilltop Road, and drive 0.4 of a mile to the intersection of Old Lee Highway and Hilltop Road. When you come to the meetings, please enter through the rear entrance. There will be a talk-in on the AMRAD Repeater (147.21 +).

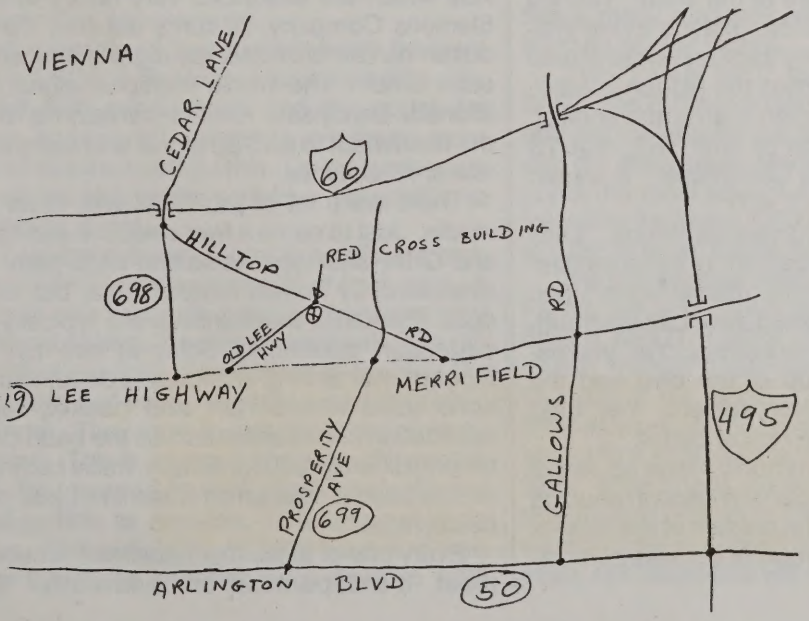
Meetings are on the 1st Monday of each month at 7:30pm. The September meeting will still take place at the Patrick Henry Branch Library, 101 Maple Avenue E, Vienna, VA.

Except for the annual meeting in December, meetings are normally reserved for technical talks - not business. EVERYONE is encouraged to addend.

After the meeting, at 9pm., most of us will adjourn to the near-by Pizza Hut for a slice of whatever, and some liquid refreshments.

You do NOT need to be a member of AMRAD to attend!

EVERYONE IS WELCOME ! See you there!



DIGITAL RAMBLINGS

Hal Feinstein WB3KDU

Trying to adopt digital protocols to hf seems to be the next exploit that hams are going to attempt. Is it easy? Some say yes, and some say no. I'm one of the doom-sayers who, having the honor of being around the design of a commercial type hf protocol, don't think it's so easy. So it was with some feeling of uneasiness and not a little deja vu that I sat in this red neck bar complete with it's carry-out hard liquor store, parking lot full of pick'em trucks and populated by a human sub-specie that makes a lie of Darwin's theory of evolution. Why here? It's got GOOD PIZZA says our meeting organizer, a man I had great respect for, --up till that moment.

Now I'm not going to reveal who was at this meeting, they know who they are, and besides I'm having too much fun describing it. We all sat at this side table, partly because "inside", where the bar is, was too loud. Besides the noise and beer smell (par for this kind of bar) I think it was pay day (a traditional pagan festival day) or they were practicing for it. They even had LOUD electric-country-rock-a-billy music from the juke box.

Thus, as Tacticus, with gravity and respect for the skilled enemy we had come to battle, in this bar, our organizer began. Purposefully, he began his outline. His proposals carefully organized. His conclusions air tight. Then I woke up: did he say the word STANDARDS? " Why yes in deedy, my boy. That's why I've brought you all here. After all, standards is what SMART PEOPLE are doing these days in computers. Don't you know notin'?"

Now, I've been around standards committees before. I know the symptoms: hours of wrangling about the obvious; vendors trying to get their product certified as the only smart way to do something; dedicated individualists finding pleasure in mob rule; apolitical technical people suddenly discovering the pleasure of the snub. Yes, it's all here in the standards committee. (Maybe Irving Wallace or Alex Halley will take up my idea and write a hard hitting novel set in L.A. that exposes the hidden conflict, the triumph and the loss, the human drama and conflict. It would be called, in the tradition of AIRPORT, ROOTS and BICENTENNIAL simply "The Committee." It should be set in Newington you say, not L.A.?)

Standards committees can do various things. They can be used to specify an organized set of services (service definitions), they can identify mechanisms upon which services might be implemented, they can even suggest or mandate specific implementations. Yet, you assume the committee is made up of the best and the brightest talent available for a given subject. Yes, I did too, once, a long time ago. Now, I know better.

Standards committees are commonly made up, not of the best and brightest, but of people with enough chutzpa to be convincing. And they must be present at the various meetings as well. Standards (the output of these committees) can be used to close up the market places too. A standard can be offered to the federal government such as IBM did with the Data Encryption Standard (now called Federal Information Processing STANDARD 46) Hence, everyone must use this product and better or different products are negated. (Something that would never happen in the amateur radio community I'm told)

Back at OUR meeting, in the bar. First of all, some of us actually said that we didn't know how to do hf data experience is with an hf protocol called "serial tone" by industry folks, really the first time I've heard of it by this name. It's based on a tone scheme of eight carefully chosen tones which represent golay encoded data blocks. The protocol was designed for automatic link establishment (HF-ALE is our name for it). A lot of thinking went into designing HF-ALE and I've had just some of this rub off on me.

Another hf protocol that's been around a while is PICOLLO. This was a British invention and has been with us since the early 1960's. I've heard this kind of transmission on short wave a few times, and can report that it sounds like Chinese wind chimes being blown about by an electric fan. Both PICOLLO and HF-ALF use a form of m-ary FSK. PICOLLO seems to use five or six different "channel" offsets, while HF-ALE uses eight. People in the industry call these offsets "tones" (probably from the old RTTY multiplexing days).

Another participant described a thirty nine tone system used for data transmission with a whooping price tag. This is not a serial tone system like PICOLLO or HF-ALE, but a true multi- tone in which several different tones are on at once.

If you've listen to the utility sections of the shortwave bands, you must have heard sounds that are like an old propeller airplane. They are multi-tone multiplexing signals which are described very nicely in a book by the Siemens Company. It turns out that they are about a dozen narrow shift teletype signals spaced very close to each other. The whole multiplex signal fits into three kilohertz bandpass. Another variation is to devote half of the bandwidth to an SSB signal and leave the rest for narrow shift teletypes.

There are a lot of problems with hf as a cooperative media. Just to name a few: selective and flat fading, QRM and QRN, shot type noise and multi-path. Each can be overcome by known mechanisms, but they do have a cost. Primarily, mechanisms are typically forward error correction, commonly Golay at rate 1/2, or BCH; two types of interleaving: shallow and deep; common ARQ notions used with SITOR and packet, replication and duplication of bits either across the baud or "horizontally" among different bauds. Finally, trellis coding ideas, which code a baud so that an error within a baud can sometimes be corrected.

Every one of these mechanisms cost something. With most, it's expansion of bandwidth. Many require

synchronization, since they have the notion of a frame associated with their methods. Others, like interleaving, require buffer space; and forward error correction requires some processing power. Combating multipath means specialized modems.

What makes all this possible is digital signal processing (DSP). Here is where good things may be happening. There was the Dalanco- Spry board with the TMS-32010 giving us about 5 MIPS of processing power. This is entry level for DSP, and we have been only using it for elementary things. Faster processors are available, and will probably be needed. Rumor is that someone is going to make a low cost system using a faster chip (available for about $200), however, this is still a rumor.

Yes, we're in the experimenting stage with this, and standards are not yet needed. We mustn't be rushing off to solve the problem before we understand it. It's just asking to be replaced by the first better idea. Look at the network layer of packet radio if you don't believe me.

Backbone Networks

by David W. Borden, K8MMO

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Oakton, VA 22124

The Secret Backbone

It has come to the attention of this author that a dozen worthy packet workers have constructed a backbone piece of the amateur packet radio network that operates between 430 and 450 mHz at some baud rate other than 1200 baud. This calls for some history of amateur "secret" frequencies and codes to be written down, before some amateur of renown attempts to tell you this is fine business and "the old man" would be proud of this activity. The first "secret" work that comes to mind has always been considered to be legitimate. It is the control of amateur voice repeaters on "non published" frequencies using non-published touch tone codes to turn the repeater off and on, control the autopatch, and other functions. The trouble with these frequencies being secret is that if one of us is looking for a quiet place to put a packet channel, we hit them and cause trouble (resulting in a call or visit from Gary, W3DTN and the TMARC thought police). But, in general, we all see the need for repeater control links, even though I think they could be shared better (using a packet radio controller, for example).

Another clear example of legitimate "secret" frequencies and codes is OSCAR. The frequency for satellite control, the doppler shift experienced and the codes for controlling the spacecraft have always been non-published. We all see the need for this. Do we want some person to turn on the kick motor and drive the satellite to Jupiter? No, of course not.

The packet backbone being secret is a different matter. It is analogous to private repeaters of long ago. A private repeater is one that only paid up members may use (not just the autopatch, the whole repeater). The difference is "denial of service". Their intent in keeping the frequency, baud rate and everything else secret is to keep you off the channel. They want to only have "their" packets be propagated. This is a bogus concept. If I want to transfer a large file, I want to go in at a fast baud rate and use the channel as little as possible. I do not want to go in on a Local Area Network (LAN) at 1200 baud and then up to the higher baud rate and then back down to 1200 baud at the distant LAN. That is a bottleneck effect. I want a fast pipe. Construct your own they say, keep off of ours. Well, AMRAD is doing that, but their backbone should be open.

The AMRAD "OPEN NET" Backbone

Anyone is welcome to use the AMRAD "OPEN NET" backbone. All you have to do to get on is:

a. Buy a 56kb modem kit from the Georgia Radio Amateur Packet Experimenters Society (GRAPES).

b. Purchase crystals for the modem (2).

c. Purchase a transverter at a hamfest - the Microwave Modules 432 mHz is best. That will get you up to 9 watts (measured).

d. Purchase an amplifier to bring the 9 watts up to some loud value, like 60 watts.

e. Purchase a beam and point it at K8MMO, or Channel 9's tower, or AJ9Xs house.

f. Purchase some hardline, so as not to loose too much in the coax.

g. Purchase an Eagle 8530 Card (AJ9X will give you a source - $25).

h. Obtain software from AMRAD to make the Eagle Card do 56kb (WA3CVG is working on this).

i. An alternate plan to make the bits is to get a PS186 minimal kit from TAPR and populate it (do not know that this is really available yet) or wait for AEA to market the finished packet switch.

The "OPEN NET" backbone is coming along well. BARC (the Baltimore Gang), has purchased 4 modem kits and are looking for transverters and amplifiers. I would say the Microwave Modules transverter is going to become the most sought after piece of equipment at hamfests (like the Xerox 820 board was once). We will all arrive at 0730 at every future hamfest to scoop them up.

The software we intend to run on this backbone is Phil Karn's net.exe. This program now does AX.25 (Jon Bloom, KE3Z), TCP/IP (the original idea from Phil Karn, KA9Q), theNET (Dan Frank, W9NK) and work is underway to make it do ROSE. When Art Goldman, WA3CVG, finishes work on the Eagle driver to make it go 56kb (the speed limit at present is 9600), we will have an instant network. Mike Bruski, AJ9X and myself intend to experiment with routing protocols (like ANSI routing, and RIP). If you want to take in some 1200 baud circuit and put it out at 56kb, our backbone will shove it up North for you, this is

"OPEN NET"! Gosh, I guess we will not even complain if you stuff in some of that PBBS stuff, although the latest net.exe has an AX.25 personal mailbox. Personal mailboxes are neater than the PBBS concept. I can say that since I ran a PBBS for a year. What a bad idea that was, it is UUCP all over again. Every packeteer should have their own mailbox and get their mail when they get home from work.

So get all the stuff on the checklist and get on the backbone. AMRAD the club has bought one which we shall deploy to Channel 9 most likely (unless a better site shows up). Remember "OPEN NET", not private club.

For our next trick, we want to try 1mb using the Andre N4ICK spread spectrum lockup scheme. Anyone for an experiment?

The President's Ramblings:

Three Amplifiers for VHF and UHF Use.

by Andre Kesteloot, N4ICK

Recent experiments in spread-spectrum reception have forced me to find gain, lots of gain. I do like to use building-blocs which supply me with a given gain figure, as I can then plug these "bricks" at any point of my configurations, while keeping everything else constant. The following is a description of three such "bricks."

Hamtronics: For low-noise amplification, I have been quite pleased with the Hamtronics LNW-432 Miniature GaAsFET preamplifier. It comes as a kit, easy to assemble if you have some previous experience in VHF work. (Note that the input coil L1 must be mounted parallel to the board, and not perpendicular, as shown on Hamtronics' figure 3 of their instructions manual.) All parts supplied fitted nicely, and the instructions shipped with the kit were quite adequate. I completed the assembly of my unit in a few hours, including the drilling and labeling of a suitable diecast aluminum box. The preamplifier worked as soon as turned on, and did not show any inclination to oscillate. By slightly stagger-tuning the input and output circuits, it is possible to obtain 15 dB of gain with a -3 dB bandwidth of 75 MHZ (from 405 MHz to 480 MHz !) Of course, if you peak the two circuits, you will get much more gain, but for my own purpose, what I wanted was a minimum of phase distortion over the whole 70 centimeter ham-band. My own spectrum analyzer does not have a plotter output, and I had to ask Chuck Phillips N4EZV, to plot the response of the pre-amplifier on his spectrum analyzer (see figure 1. Note that the horizontal scale is 20 MHz per division, while the vertical scale is adjusted for 10 dB per division.)

Radio-Shack: Another amplifier I use all the time as an all- around 10 to 20 dB gain building-bloc is the Radio-Shack model 15-1113 UHF/VHF/FM Amplifier. It supplies gain from about 50 MHz to 1GHz, comes in a nice, sturdy metal box and includes its own built-in 117 volt AC power supply. The gain is adjustable from +10 to +20 dB. You can't beat that for $19.95 ! Again, N4EZV supplied the frequency response shown on figure 2. Note that the frequency response of the unit we tested was fairly flat from 55 to 500 MHz, "bumpy" but within 3dB from 500 through 800 MHZ and still usable --albeit with reduced gain-- through 950 MHz. Although the unit is designed for 75 ohms input and output impedance, it operates very well with 50 ohms source and termination. Figure 3 shows the response of the same unit when the "FM filter" is switched in (this is a band-rejection filter.)

MMICs: Finally, if you haven't done so yet, try and get an MMIC with which to experiment (about $2 each in small quantities.) I got a few units from Mini-Circuit Labs and was delighted with their ease of use. Figure 4 shows a typical circuit. Note that the input-biasing arrangement is built inside the MMIC, and that in theory, one external resistor (connected between the +Vcc and the MMIC output lead to limit the DC current) is all you have to supply. This limiting resistor is determined by the application of Ohm's law. (The Mini Circuits Lab MMIC type MAR-8 which I selected had the following advertized parameters: 20 dB of gain up to 1 GHz and a maximum output level of +10dBm.) With the recommended operating voltage of 7.5 volts, a Vcc of 12 volts DC, and a recommended operating current of 36 mA, the dropping resistor will be 120 ohms. In practice, however, since the output impedance is 50 ohms, such a low-value resistor in parallel with the output will tend to lower the overall gain. To maintain maximum gain I have thus found useful to insert a small RF choke in series with the DC supply (see figure 4.) This RFC consists of 10 turns of insulated wire-wrapping wire wound over a #60 drill-bit (that is 1 millimeter for you Metric Fans), and then spread a little.

By cascading two MAR-8, I was able to obtain an amplifier with an overall voltage gain of 160 (44dB)

Ideally, chip capacitors should be used to maintain best impedance match, but if you don't have any around the old ham- shack, you can use regular ceramic capacitors. The latter however do have some lead length, introducing some inductance in series with the input and output leads. This tends to insert some bumps in the overall frequency response, particularly above 600 MHz.

I used double-face printed circuit board for some of my amplifiers, and rather than actually etch the surface, used a sharp X-acto knife to cut out little "islands" from the copper surface. Once such an island has been drawn and cut around the periphery, you can peel off the unwanted copper while heating the surface of the portion to be removed with the tip of your soldering iron. (For more details, see for example two very good articles on MMIC amplifiers,

one written by Jerry Hinshaw, N6JH in the March 1986 issue of Ham Radio Magazine, the other written by Al Ward WB5LUA in the February and March 1987 issues of QST.) MMICs are really easy to use, and best of all, if you remember to take even a minimum of precautions, they will not oscillate!

Keep on experimenting with RF, for there would appear to be only a few of us RF-hackers left a hacking!

73 de Andre, N4ICK.

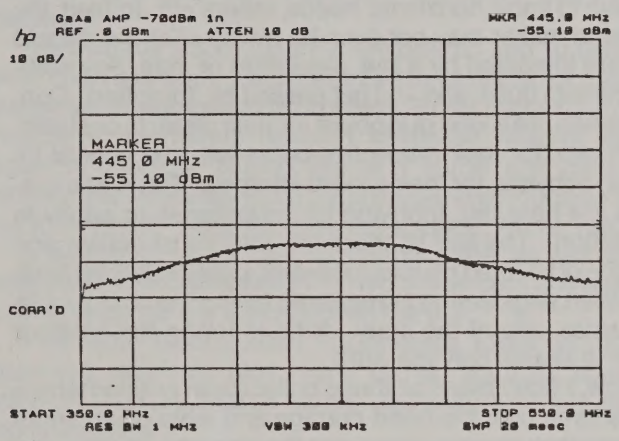


Figure 1.

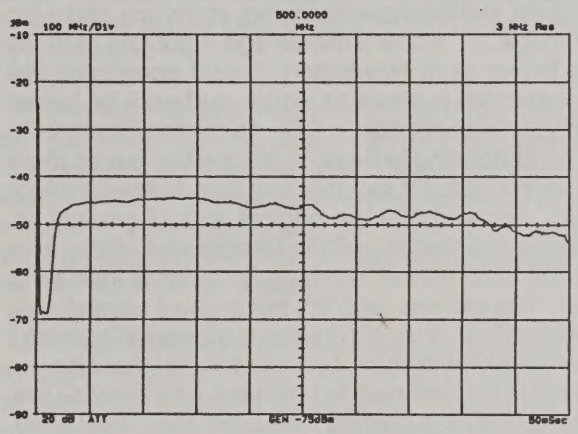


Figure 2.

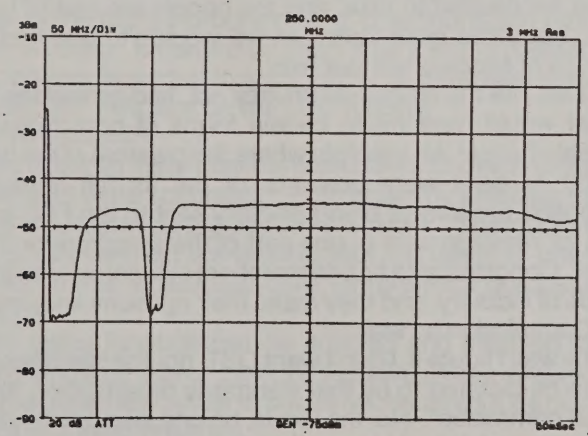


Figure 3.

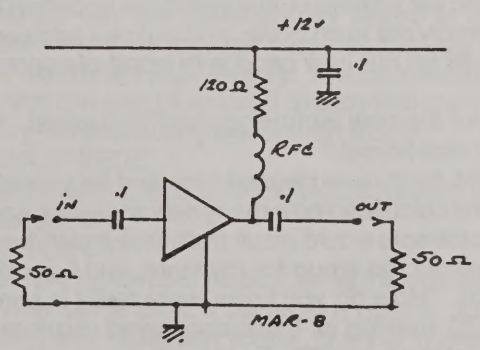


Figure 4.

The ARRL and the Theory of the Leisure Class.

Hal Feinstein WB3KDU

I must admit, at times, typically after two in the morning, I sometimes feel guilty about all the league bashing that I hear. Well, not really that guilty. But, I suppose someone should say something good about them, sometimes.

I'm not about to justify, or explain, the things that can still get a good argument going at any gathering of more that one ham, like incentive licensing, cronyism, and a big brother image. About a month ago, I got one of those dunning letters from Newington. It said something like your membership is about to expire, and we'll be forced to cut off your subscription to QST (a reason for regret?). Now in good dunning letter style, each letter is a bit more nasty than the last. I'd say this one was at the "chiding" level. (It's rumored that the original idea of gradual escalation was invented by a State Department official after reading his "final notice" dunning letter on a loan for a fancy car. The car was repo'ed, but gradual escalation is now standard fare; an ode to its unsung founder Dunning.)

To complete the picture, I should tell you that I have a good friend in the land mobile business, who like the Dunning letters, is always chiding me about "their" new band, --220Mhz. He said he heard at a national trade show that there's an FCC person, who, whenever anyone comes up with an idea for a product, like the electric spoon, always says yep, we'll put it on 220Mhz! Why not file your paperwork with us and -oh yes, make the choice of frequencies look like YOUR idea. So much easier that way.

"You can't win", he said. "You try fighting these things on merit, but that's not their strategy. They'll simply swamp you with a few dozen vendors all trying to get their pet idea a few kilohertz of spectrum." "The vendors come to the FCC hat-in-hand sayin', 'Please tell us how we can get our electric cat shaver, or automatic hat tipper on the air.' 'You'll simply get worn down, and pushed aside and, then we can fill up our new band with good ole narrowband FM.'"

"What about the new technology stuff?", I asked. His answer: "A Trojan horse!."

The thought must have pleased him, and he chuckled to himself as he calculated how many new accounts, sales and service contracts would result from their "new" band. He looked entirely too smug for my taste, and I decided to try a gambit. "How do you know there really is someone in the FCC steering all these cock-eyed devices to our 220Mhz amateur band?" To this I got one of those looks that said: if you knew anything, you wouldn't ask that question. And quizzically, "one never know, do one?"

I find myself standing at a familiar address on M street in Washington, D.C.; looking at the people, trying to guess their occupations and what unseen forces they move or are moved by. It all comes home to you when you dart into one of the cloned office buildings in this part of town: lobbyists. There's hundreds of them in Washington. Why are they here? Because this is where the decisions are made that say how the vast resources of this country are to be apportioned. What do they do? They try to make sure that when the list of issues are drawn up, their clients' interests are near the top. It's not illegal, and what's more, it makes sense.

A lobbyist knows that if he doesn't get the decision makers to know his clients' needs, others will. Indeed, the decision maker may not even be aware of all the people that are impacted by a law, regulation or rule. Say nothing, remain quiet, and you get passed by, forgotten. Congressmen are a kind of lobbyist for their districts or states; diplomats, for their respective countries; and special interest lobbyists, for their special interests. Trade associations are here too, lobbying for advantages or equity in regulation. The fact is, there are millions of dollars and dozens of talented people: lobbyists, public relations firms and even engineering consultants telling the land mobile industries side of the story. Who is telling the amateur side? It seems only the ARRL.

Now, I don't mean all those boiler room session where hams fume over the latest outrage and whip off an angry letter to their congressman, but the one who explains the amateur radio side. Who works at getting OUR concerns high up on the decision makers list of concerns? Does any other amateur group have an office down here in Washington (ARRL and I think AMSAT)? I would like to meet them if they do.

When I was new to this game and had to get special permission from the FCC to do the AMRAD spread spectrum experiments, we got a lot of help from the League's man in Washington. As he planned out the steps we needed to take, and the people we had to talk with, I became quite sure that we wouldn't have had a chance of success without him.

Laws, like the electronic privacy act, had provisions in it that would have made certain forms of ham radio a federal offense! An example where the creators of the law (good or bad) were unaware of the its full impact. Proposals are always being officially sent to the FCC asking for reassignment of one part of the spectrum or the other. Congress also has its members sympathetic to the needs of industry, and they make their opinions known to the Commission as well.

The way I figure it, I don't want QST, nor the Handbook, nor to be dictated to by that standards organization "the digital committee". No, the fact is, no one else down here in Washington is looking out for amateur radio except the League. **THAT** makes it worth joining!

EQUIPMENT REVIEW-THE REALISTIC PRO-2004 GENERAL COVERAGE AM/FM MONITOR RECEIVER

By Jack Anderson

The Realistic PRO-2004 is a 300 channel scanning monitor receiver. Introduced by Radio Shack in July 1987, this scanner covers 25 - 520 mHz and 760 - 1300 mHz. Cellular mobile telephone frequencies (825 - 844.995 mHz and 870 -889.995 mHz) have been excluded.

The scanner's 300 channels are divided into 10 banks of 30 channels each. Each bank can be activated or deactivated while scanning is in progress. Front panel controls include a membrane covered keyboard, volume and squelch controls, Sound Squelch on/off and display dim/normal. A headphone jack is conveniently located on the front panel. Antenna, external speaker, AC and DC

power jacks are located on the rear panel, as well as a switchable 10 dB attenuator. An AC power cord and telescoping antenna are supplied with the unit.

This radio incorporates the features found in most scanning receivers plus many extras, such as sound squelch, multiple search banks, assignable priority and lockout review.

Although I am not an amateur radio operator, I feel it is safe to say that this is an ideal radio for the ham who wants coverage of the VHF and UHF amateur bands at a reasonable price. It covers 6 and 2 meters as well as the 220-225 mHz, 440-450 mHz and 1215-3000 mHz amateur bands.

SUMMARY OF FEATURES

KEYBOARD

The keyboard is color coded by function - search, scan or program. Twenty-nine membrane covered keys control all of the radio's programming, operations and functions. A "beep" is generated each time a key is pressed. The operator is alerted to entry errors by three beeps and an "ERROR" indicator on the LCD display.

BANK SELECT

Any of the 10 thirty-channel scan banks can be enabled or disabled while scanning is in progress by pressing the key (0-9) which corresponds to that bank. The numeric keys on the keypad are labeled with the range of channels within that a particular bank for reference purposes.

DELAY

The delay function can be enabled and disabled for each channel or search bank individually. When enabled, delay causes the scanner to pause two seconds for a reply before scanning resumes.

One undocumented feature of the PRO-2004 is a very short delay (approximately .25 second) even when delay is not enabled. This prevents the scanner from jumping off of a weak station that may be fading or chopping.

LOCKOUT

Lockout allows the operator to skip the channels that he does not want to monitor during scanning. The PRO-2004 has one limitation with lockout: one channel in each of the ten 30 channel banks must remain unlocked.

This radio also has a handy Lockout Review function which allows the operator to step through and review the locked-out channels. Locked-out channels are displayed one at a time on the LCD display as the Lockout Review key is pressed.

PRIORITY

Priority can be assigned to any one of the 300 channels. (On most scanning radios with priority, channel one is the only priority channel.) When activated, this feature samples the priority channel every two seconds to check for activity. If the priority channel is active, the radio immediately jumps to the priority channel and remains there until the transmission ceases.

SEARCH

Limit searching can be performed by entering lower and upper frequency limits into one of ten search banks and searching between those limits. Reception mode and frequency step default to preassigned values for the frequencies being searched, and can be manually overridden if desired. Default reception mode and frequency step can be restored by pressing the Reset key.

Ten different sets (search banks) of upper and lower limits can be entered and stored in the radio's memory, then recalled for later searching. Direct searching can also be initiated from any frequency in the radio's main scanning memory by pressing the Direct key.

Pressing the Monitor key allows the operator to temporarily halt searching and monitor a frequency found during a search. Frequencies found and listened to with the Monitor key are automatically stored in one of ten "Monitor" channels for later recall and/or entry into the radio's main scanning memory. Frequencies found while searching can also be entered directly into main scanning memory without exiting the Search mode.

SCAN SPEEDS

Scan/search speed is keyboard selectable, 8/16 channels per second.

LCD DISPLAY

The front panel LCD display gives the operator a complete view of the radio's status at a glance. Frequency, operation and reception mode, channel number, active banks, monitor channel, low battery and search direction are displayed, as well as lockout, delay and priority status for each channel. The display is easy to read and is illuminated by a soft green florescent backlight panel. The brightness of the display is controlled by a front panel DIM switch.

HEADPHONE, EXTERNAL SPEAKER AND TAPE OUTPUT JACKS

Three separate jacks are provided for audio output. The headphone jack is located on the front panel. Output to the headphones is limited by a series resistor. External speaker and tape output (600 mV) jacks are located on the rear of the radio. The headphone and external speaker jacks are mini phone types, and the tape output jack is an RCA phono type.

10 dB ATTENUATOR

A 10 dB attenuator is activated by a slide switch located on the rear panel. When activated, this attenuates all incoming signals by 10 dB, preventing receiver overload and intermod by strong local stations.

ANTENNA

A 50 ohm antenna connection (BNC type) is located on the rear panel of the scanner. Radio Shack supplies a 26" telescoping whip which can be attached directly to this connector. The manual recommends that the whip be fully extended for 25- 300 mHz, extended three segments for 300-520 mHz and collapsed fully for 760-1300 mHz. I found that for best reception on VHF-Hi, UHF, and 800 mHz the antenna needed to be extended approximately 18". For best possible reception, an outside multi-band antenna should be used.

SOUND SQUELCH

One of my favorite features is the Sound Squelch. Sound Squelch, when activated, prevents the radio from locking on to an unmodulated carrier when scanning or searching. If the radio is scanning and encounters a carrier, it will stop scanning and hold for .5 second to check for modulation. If modulation is not present, scanning resumes. If modulation is present, the radio stops and waits until the transmission ends or modulation ceases for 5 seconds. Sound Squelch is enabled and disabled via a pushbutton switch located on the front panel. A red LED indicator shows the status of Sound Squelch.

BATTERY BACKUP

The scanner's memory remains intact when power is removed from the unit, provided that a 9 volt battery is installed through the plastic access door located on the rear panel. Radio Shack claims that the battery will last 6 months even if the radio is left unplugged for prolonged periods. A alarm beep will sound and the BATT indicator on the LCD display will show when the battery is weak or missing. Memory will be retained for a short period with the unit unplugged and the battery removed.

SPECIFICATIONS

Manufacturers specifications are as follows:

FREQUENCY COVERAGE

25-520 mHz
760-824.995 mHz
845-869.995 mHz
890-1300 mHz

SEARCH FREQUENCY INTERVAL

Automatic and selectable; 5 kHz, 12.5 kHz, 50 kHz

RECEPTION MODES

Wideband FM (150 kHz)
Narrowband FM (9 kHz)
AM (9 kHz)

CHANNELS OF OPERATION

Any 300 channels in any band combinations (10 banks of 30 channels each).
10 Monitor channels.

SENSITIVITY

WFM: 30 dB S/N @ 22.5 kHz deviation
25 - 520 mHz 3.0 uV
760 - 1100 mHz 3.0 uV
1100 - 1300 mHz 10.0 uV

NFM: 20 dB S/N @ 3 kHz deviation
25 - 520 mHz 0.5 uV
760 - 1100 mHz 0.5 uV
1100 - 1300 mHz 3.0 uV

AM: 20 dB S/N @ 60% modulation
25 - 520 mHz 2.0 uV
760 - 1100 mHz 2.0 uV
1100 - 1300 mHz 3.0 uV

IF REJECTION

610 mHz @ 70 mHz 60 dB

SELECTIVITY

NFM/AM +/- 9 kHz -6 dB
NFM/AM +/- 15 kHz -50 dB
WFM +/- 150 kHz -6 dB
WFM +/- 300 kHz -50 dB

SCANNING/SEARCH RATE

Fast 16 ch/sec
Slow 8 ch/sec

PRIORITY SAMPLING: 2 Seconds

DELAY TIME: 2 Seconds

SQUELCH SENSITIVITY

NFM and AM

Threshold
25 - 520 mHz 0.5 uV
760 - 1100 mHz 0.5 uV
1100 - 1300 mHz 3.0 uV
Tight S/N 25 dB

WFM

Threshold
25 - 520 mHz 3.0 uV
760 - 1100 mHz 3.0 uV
1100 - 1300 mHz 10.0 uV
Tight S/N 40 dB

ANTENNA IMPEDANCE: 50 ohms

AUDIO OUTPUT: 1.8 watts

INTERNAL SPEAKER: 3", 8 ohm, dynamic

TAPE OUTPUT

RCA type jack
Impedance 10 k
Output voltage 600 mV

POWER REQUIREMENTS

120 VAC 20 watts
12 VDC 12 watts

BACKUP BATTERY: 9 volt alkaline

DIMENSIONS: 2 7/8" x 10 1/4" x 9"

WEIGHT: 7 lbs

PERFORMANCE

Overall, I would rate the NFM performance of the PRO-2004 as very good. From my home in Annandale, VA, near the beltway, I could easily receive all police, fire and public service channels in the Metro DC area and in adjacent counties using only the supplied telescoping whip. I was also able to receive some distant signals, including a UHF business repeater in Annapolis, MD (approx. 50 miles). Virginia State Police mobiles, operating on a duplex VHF frequency, could be received as far as 10 miles away. No spurious, image or intermod interference was observed.

AM performance was good. Tower communications from Washington National Airport and Andrews made the trip, but were difficult to copy. On the other hand, reception of airborne aircraft was excellent. Reception of CB (26.995-27.405 mHz) was OK, and improved when the receiving antenna was lengthened.

WFM performance was difficult to judge. The many strong FM radio stations in the Metro area frequently caused the receiver to overload. Reception of some local stations improved when the 10 dB attenuator was kicked in, but this made reception of distant stations impossible. The radio easily received TV audio from all local VHF stations, as well as all of the Baltimore VHF stations. WFM fidelity was surprisingly good when listened to through "Walkman" type headphones or a hi-fi external speaker.

The manual supplied with the radio is well-written and easy to read. The radio itself is easy to understand and program. If you have used a non- Radio Shack scanner for years (like me), you'll have to get used to doing a few things differently, such as programming frequencies and searches.

GRIPES

My only real gripe about the PRO-2004 was its scan/search speed. Sixteen channels per second is just not fast enough. Other scanner manufacturers have introduced units with scan/search speeds of 30-60 channels per second. This would make searching for new frequencies a snap. The operator risks missing transmissions if a frequency spread of more than a few mHz is searched with 16 channels/second.

If you intend to use the PRO-2004 in your car, take note of the following-this radio does not come with a mounting bracket, nor does it have any holes provided in the housing for one.

In the "Things I'd Like To See" department, how about a "Duplex Delay" feature? Such a feature would allow the operator to program a duplex frequency pair for "Duplex Delay". When a transmission occurs on one of the two channels in the pair, the scanner scans both channels in the pair during the two second delay period for a reply, then resumes scanning on all of the other channels. I miss a lot of replies on duplex pairs with the current setup.

In 1985 purchased what I thought was going to be "My Last Scanner". (I have owned a total of 7.) It had everything I needed (at the time) and did a

fantastic job of receiving the many VHF-Low frequencies of the Baltimore County Police and Fire Departments. I was very happy with it.

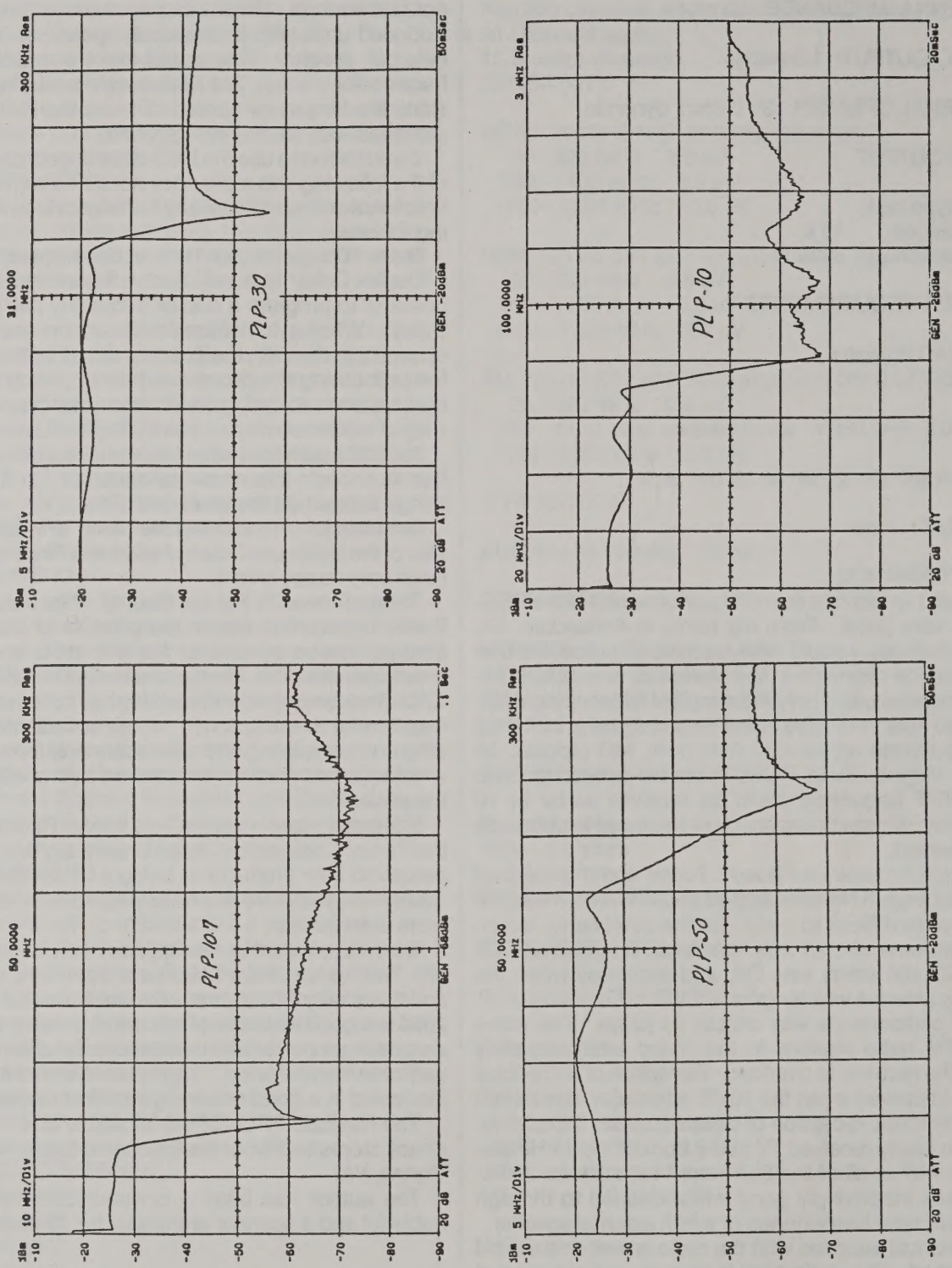
Then I moved to Fairfax County. The Fairfax County Police Department was in the process of converting its communication system to the 800 mHz band when I moved here in 1986. That, plus a look at the latest POLICE CALL frequency guide was enough to convince me that it was time for a new scanner. I spent several months shopping and comparing 800 mHz scanners, trying to decide which offered the most features and best performance for the price.

For many years I was not very fond of Radio Shack and the Tandy Corporation. I can't really say why, perhaps I perceived their products as being a bit overpriced for the quality. As an electronics hobbyist, I found their prices for parts outrageous.

It now appears that Radio Shack has begun to shift a bit. Their prices have become a little more reasonable, and the quality of their products has improved. The PRO-2004 is a good example of this trend. I was unable to find a scanning receiver with a better combination of features, performance and price. I highly recommend it for anyone interested in a good scanning monitor/receiver.

The Realistic PRO-2004 is available at all local Radio Shack stores and from the Electronic Equipment Bank in Vienna, VA.

The author has been a communications/electronics hobbyist and a scanner enthusiast for 15 years.



Mini-Circuit Labs Filters Amplitude vs. Frequence

The New Mini Circuit Labs Filters

by Chuck Phillips, N4EZV.

About mid-morning a few Saturdays ago, I had decided that the lawn could go another week, that I would drive the truck through the car-wash and that I might make it another three or four days before getting a haircut. I also wanted to play with a new toy in the ham shack in the form of a Hewlett-Packard pen-and-ink plotter. Hopefully I might get the spectrum analyzer to talk to the plotter, and if the sweep generator was prepared to sweep, and the spectrum analyzer to analyze, then we might even get somewhere...

You should also know that I had recently acquired a number of those new Mini-Circuit Labs filters and wanted to see what they really looked like in real life.

After reading the Hewlett-Packard plotter manual (3 times), hooking everything up by the book, hooking up the D.U.T. (Device Under Test) I was sure I was ready. I punched the GO button and,...nothing happened. This time, I really read the instructions.. all was correct, but still nothing. One hour, four cups of coffee, one Pepsi and several "expletives deleted" later, I finally discovered that you must "reload" the plotter after the initial turn-on. Ah well... On the previous page of this newsletter, you will find four amplitude vs. frequency plots, for the Mini-Circuit Labs filters PLP-10.7, PLP-30, PLP-50 and PLP-70. These small filters are designed to operate into 50 ohms. They are built in shielded enclosures and make nice building-blocks. All sweeps were completed in about 30 minutes and should be self-explanatory. If not, call Chuck N4EZV at (301) 257-3398 on Saturdays, and we shall discuss it. The test equipment consisted of a Hewlett-Packard HP-7550A plotter and an IFR A7550 Spectrum Analyzer and Sweep generator. The filters are available from Mini Circuit Labs, P.O.Box 166, Brooklyn, N.Y. 11235; tel (718) 934-4500.

OLD DOMINION ENDURANCE RIDE

Dave Rogers N4JGQ & Bill Pala WB4NFB

The next event is the World Championship endurance ride on September 24-25. The Amateur team will be involved in the normal tracking, administrative, health and welfare communications. We will be using a portable repeater on 2 meters and a digi-peater on 220 MHz located on top of a moutain in the middle of the course. Many entrants are coming in from all over the world for this event. This is like the Olympics for this sport and is sponsored by the F.E.I. World organization. The festivities will start on the Wednesday before the race and continue through the banquet on Sunday. This event requires about 30 amateurs on Saturday and Sunday - if you are interested in helping please pass your name and call to either N4JGQ or WB4NFB.

AMRAD MEMBERSHIP APPLICATION/RENEWAL

Mail to: Membership, AMRAD, P.O. BOX 6148, McLean, Va. 22106-6148

ANNUAL DUES: Regular $15; 2nd in family at same address add $8; Canada and Mexico add $2; foreign surface add $2.30; foreign air mail add $8; currency is US dollars. A donation to the WD4IWG/R repeater fund is appreciated if you use the repeater. Please make checks payable to AMRAD.

Name_____ Amateur Call_____License Class_____

Street Address_____

City_____State/Prov_____ZIP/PC_____

Country_____ Home Phone (___)____-_____ Work Phone (___)____-_____

Special Interest Groups: please indicate your interest.

__Deaf Comm __RTTY __Spread Spectrum __Packet Radio __Digital Signal Processing

Network: CompuServe ID:_____

_____ ID:_____

Packet Radio mail box _____ ARRL member?____

AMRAD

The Amateur Radio Research and Development Corporation (AMRAD) is a worldwide club of several hundred amateur radio and computer experimenters. It is incorporated in Virginia and is recognized by the U.S. Internal Revenue Service as a tax-exempt scientific and educational organization.

AMRAD's Purpose

The purpose of AMRAD is to: develop skills and knowledge in radio and electronic technology; advocate design of experimental equipment and techniques; promote basic and applied research; organize technical forums and symposiums; collect and disseminate technical information; and provide experimental repeaters.

Meetings

Meetings are on the first Monday of each month at 7:30 P.M. at the Red Cross Building, Merrifield, VA. If the first Monday is a holiday, an alternate date will be announced in the newsletter. Except for the annual meeting in December, meetings are reserved for technical talks - not business.

WD4IWG Repeater

WD4IWG/R is an open repeater for FM voice and digital communications, especially for experimental modes. It is located in McLean, VA. It features semi-private autopatch available to licensed members. Frequencies are: 147.81 MHz in and 147.21 MHz out. The repeater director is Jeff Brennan, WB4WLW.

Westlink Report

The Westlink report is aired every Sunday night at 8:00PM on the WD4IWG repeater.

WB4JFI-5 Digipeater

WB4JFI-5 is a 1200-baud AX.25 Level 2 digipeater operating on 145.01 MHz. It is located in northwest Washington DC at Wisconsin Ave. and River Rd. The digipeater is mounted at an elevation of 350 feet on the south leg of the WUSA/WJLA TV tower.

Data Address

Our CompuServe/Micronet number is [72345,1050].

AMRAD Computer Bulletin Board System

AMRAD CBBS, (703) 734-1387, is operated by Lawrence Kesteloot, N4NTL. The system accepts calls at 300, 1200 and 2400 baud. The data path settings are 8 data bits, 1 stop bits, and no parity.

HEX Bulletin Board System

Handicapped Education Exchange, (301) 593-7033, is operated by Dick Barth, W3HWN. HEX accepts 110/300 baud ASCII and Baudot deaf TTY/TDD calls.

Affiliations

AMRAD is affiliated with the American Radio Relay League (ARRL), Foundation for Amateur Radio (FAR), Northern Virginia Radio Council (NOVARC) and the Mid-Atlantic Repeater Council (T-MARC).

AMRAD Newsletter

The AMRAD newsletter is mailed six times a year to members and other clubs on an exchange basis. Technical articles, product announcements, news items, and other copy relating to amateur radio and computing is welcome. Honorariums at a rate of $0.10 per 50-character printed line ($20 maximum per author per issue) is paid for original material accepted. Classified ads are free to members. Commercial ad inquires are invited. The editor reserves the right to reject or edit any portions of the copy. Items should be mailed to Editor, AMRAD Newsletter, P.O. Drawer 6148, McLean, VA 22106. Full permission for reprinting or quoting items is granted provided that credit is given to both the author and the newsletter. Membership in AMRAD is $15 annually ($8 for second member of same family). Mailing to U.S. and possessions is by 3rd Class bulk mail. Canadian and Mexican addresses add $2 for postage. Overseas readers add $8 for air mail or $2.30 for surface.

AMRAD Officers for 1988 are:

Andre Kesteloot	N4ICK	President, Director	(703) 356-5519
Terry L. Fox	WB4JFI	Vice President, Director	(703)698-7621
Gerald Adkins	N4GA	Treasurer	(703) 538-6936
William P. Pala Jr.	WB4NFB	Secretary, Alt. Director	(703) 764-3710
David W. Borden	K8MMO	Director	(301) 859-0400
Jeffrey Brennan	WB4WLW	Director	(703) 354-8541
Elton A. Sanders	WB5MMB	Director	(703)281-1298
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